Space Weather Technical Forecast

Issued on Thursday, 03 August 2023 at 01:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-class flares giving R1-R2 Blackouts expected daily. Glancing blow CME arrivals anticipated Days 2-4 (04-06 Aug) with G1/Minor Storm possible.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate solar activity with occasional M-class flares, peaking at M1.7 at 02/1452 UTC from AR3380 in the southwest. There are now eight numbered sunspot regions on the visible disc. The largest region is AR3380 (Eac/Beta-Gamma-Delta) in the southwest. It is still exhibiting magnetic complexity and has recently developed a delta configuration within its intermediate penumbra. AR3392 (Eai/Beta), a moderately large region in the northeast of the disc, has shown minor re-distribution of its intermediate spots, and has grown in overall size once more. AR3386 (Cho/Beta), another moderately sized region (the second largest on the current disc) and is located on the northwest of the disc and appears relatively stable. The other regions are smaller and simpler and have shown little change. A NEW region is emerging in the southeast, this is tentatively classified as Hsx/Alpha. A full-halo CME was observed leaving the Sun around 02/0900 UTC. This is expected to arrive at Earth either Late on day 3 (5th) UTC day or early on day 4 (6th). Also, two filament lift-offs from the northeast disc late 31 Jul (and observed on C2 imagery early 01 Aug) are considered to have Earth-directed components.

Solar Wind / Geomagnetic Activity: The solar wind at L1, as measured by ACE, was at mostly slow-ambient levels, between 370 and 400 km/s. Density was average or above average, with a period peak close to 20 ppcc around 02/1400 UTC. The total interplanetary magnetic field strength (Bt) was at weak to moderate levels with a peak of 12nT at 02/0412 UTC. The north-south component was also weak to moderate with a more prolonged southward directed orientation after 02/0400 UTC. Phi angle was initially negative (away from the Sun), becoming positive (towards the Sun) around 02/1300 UTC. Geomagnetic activity was Quiet (Kp 1-2) with Active intervals 02/0900-1800 UTC.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux varied from background to moderate levels. The associated 24-hour integrated fluence remained below the Active level (1e8 integrated pfu), with 6.16e6 integrated pfu recorded at 02/2359UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Activity is expected to be Moderate, with a slight chance of becoming High. This is mainly due to the potential for M-class flares, along with a slight chance of X-flares, from AR3380 on the southwest disc. Other regions contribute to the flare risk, including a recently emerged region in the southeast.

Solar Wind / Geomagnetic Activity: Two CMEs may give glancing blows on Day 2 (4th Aug), but possibly into Day 3 (5th Aug). A further CME may impact Earth later on day 3 or early day 4 (6th Aug). Solar winds largely remaining at slow-ambient levels, perhaps becoming slightly elevated 400-500km/s late Day 2 or more likely Day 3 due to HSS and potential CME influence. Low confidence in details. Geomagnetic activity is expected to be Quiet to Unsettled (Kp0-3) on day 1 (3rd Aug). From day 2 through to day 4 there is the possibility of CME impacts as well as a CH HSS. Geomagnetic activity likely to becoming Unsettled to Active with a chance of G1/Minor Storm intervals from late Day 2 into Day 4.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is currently at background levels. There is a slight chance of enhancement from any notable flares that occur, most likely emanating from AR3380. The high energy electron flux (greater than 10 MeV) may have diurnal peaks at High (1000+ pfu) levels Day 1, but is likely to drop out due to HSS or CME influence Days 2-4. The associated fluence is most likely to remain below the Active threshold (1e8 total pfu).

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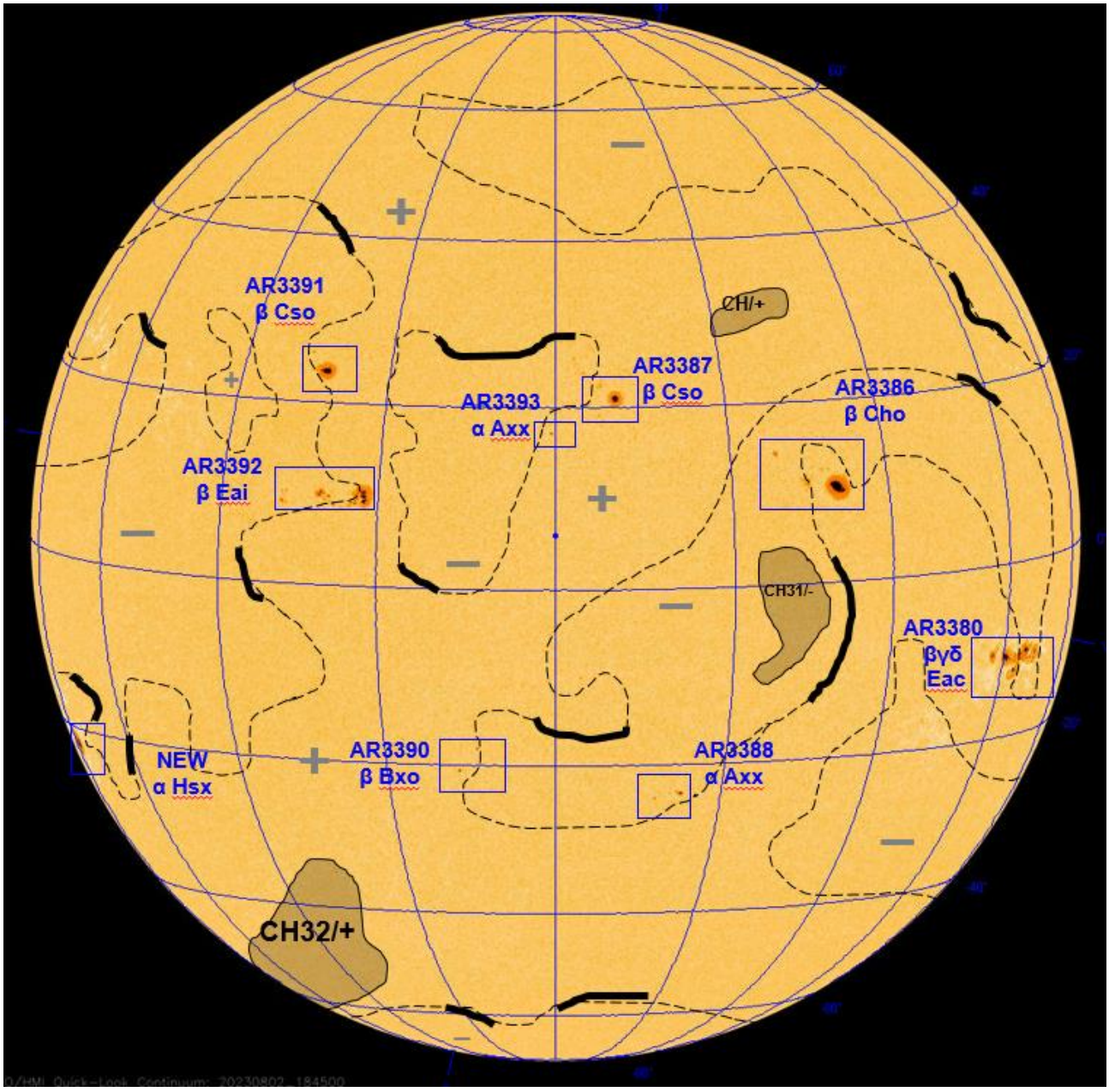
Figure 1. Solar Analysis Valid 02/1900UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A disappearing solar filament occurred in the centre disc from 31/1800 UTC, alongside a C5 flare from AR3380 with a CME, considered to be associated, appearing towards the southwest. In addition, two filament lift offs from the northeast disc produced a CME towards the northeast. Both of these are considered to have an Earth directed component, with arrivals anticipated on Day 2 (04 Aug), but possibly early on Day 3 (5th Aug). Low confidence due to lack of Stereo-A imagery available for analysis. A full-halo CME left the Sun around 02/0900 UTC. This has been modelled to arrive either late on Day 3 or early day 4 (6th Aug).
Solar winds are currently at slow-ambient levels, but close to slightly elevated levels. Influence is set to wane through Day 1 (3rd Aug), with the next enhancement from connection to a high speed stream (HSS) from either CH31/- or an unnumbered CH/+ in the north-centre disc. Both these features are low confidence however, but are coincident with larger and stronger coronal holes on the previous rotation. Any enhancement from these features is expected to be either late Day 1 (3rd Aug) or more likely Day 2 (4th Aug) which may coincide with potential CME glancing influences to give speeds of 400-500km/s. Geomagnetic activity is expected to be Quiet to Unsettled (Kp0-3) on day 1 (3rd Aug). From Day 2 through to Day 4 there is the possibility of CME impacts as well as a CH HSS. Geomagnetic activity likely to becoming Unsettled to Active with a chance of G1/Minor Storm intervals from late Day 2 into Day 4.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	30	30	30
Strong	G3	No	1	5	5	5
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
01/0701	Partial	Filament eruption	NE	599	04/0300 UTC	Glancing blow
01/0827	Partial	Filament eruption	SW	424	04/1400 UTC	Glancing blow
09/2122	Full	Filament eruption	Centre disk	480	05/2359 UTC	Direct hit

Figure 2: MOSWOC Enlil

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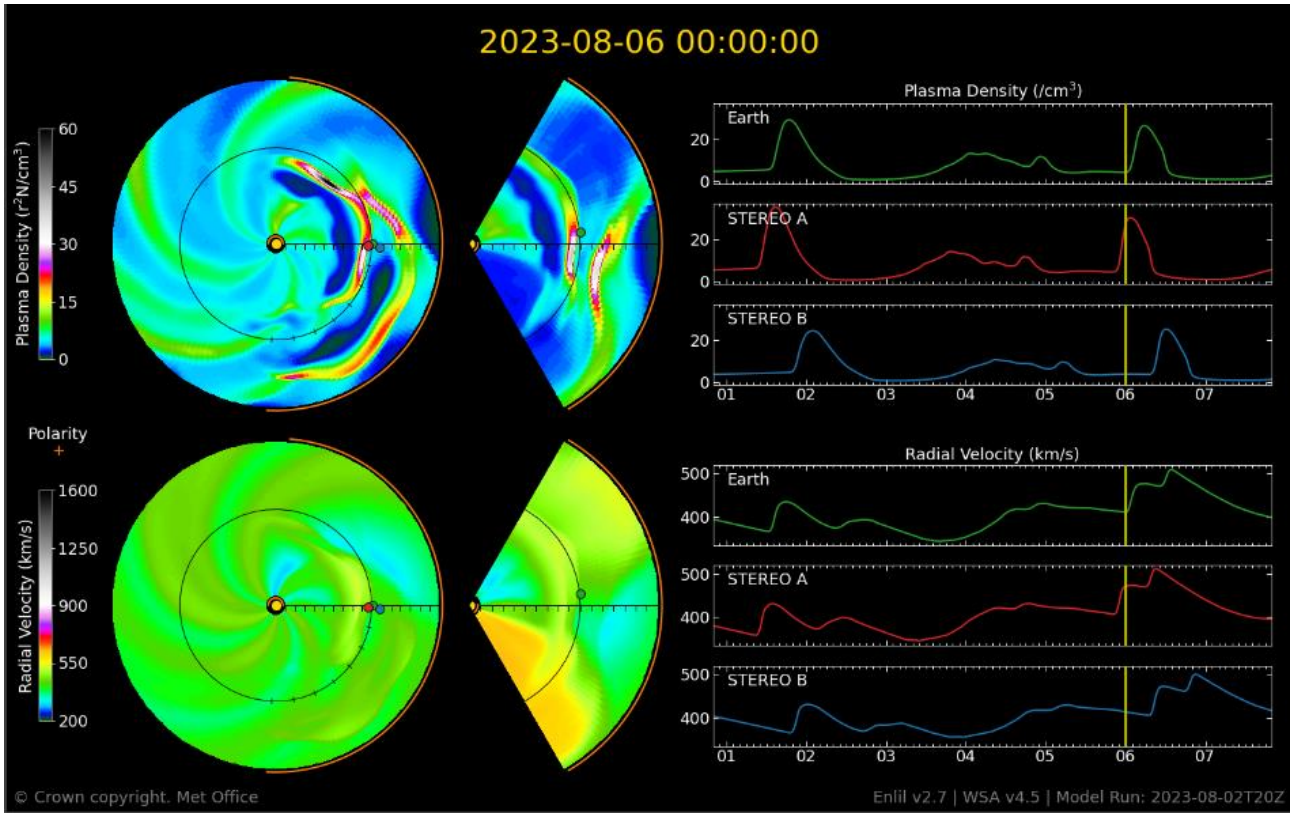

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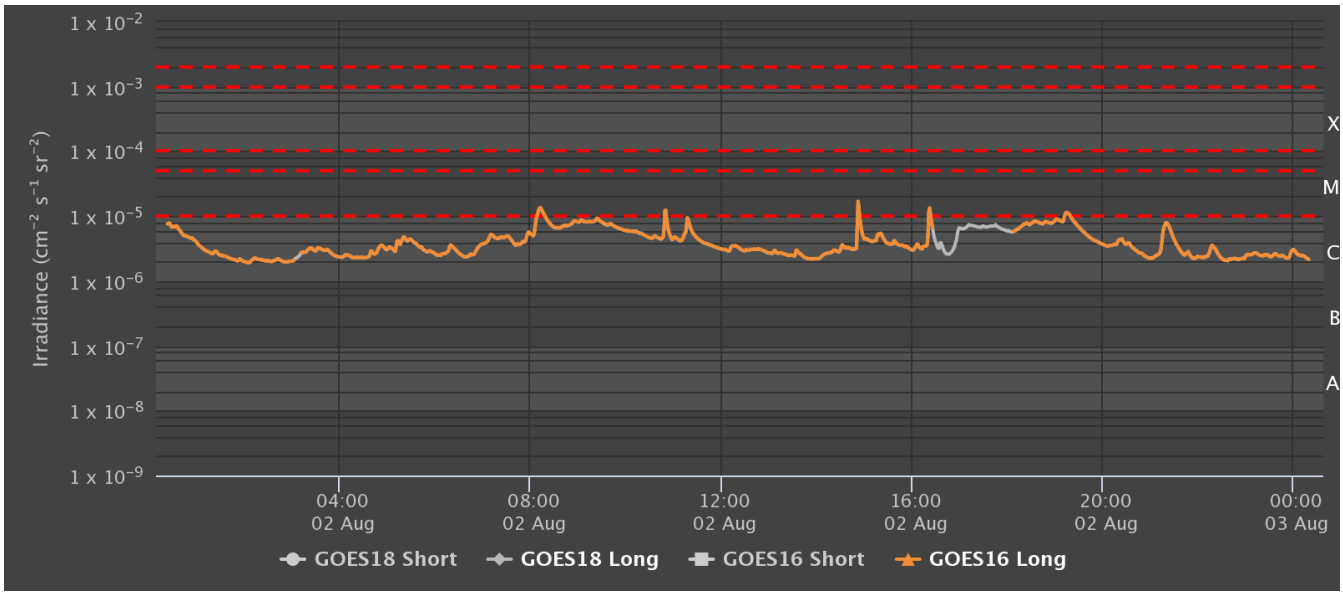
Radio Blackouts - X-Ray Flares:
Solar activity is Moderate. There are currently nine sunspot regions on the visible disc. The largest and most significant region on the disc remains AR3380 in the southwest. It is still exhibiting magnetic complexity, and a delta spot has been observed within its intermediate region. This region is fairly unstable, and has been the source of a number of M-class flares over the past 24 hours. Stronger flares remain possible, with further M-class flares expected and a slight chance of X-class flares. Of the other regions on the disc, the only ones of note are AR3392 (Eai/Beta) in the northeast and AR3386 (Cho/Beta) in the northwest. The former, a moderately sized region, has shown some proliferation of intermediate spots. AR3386, another moderately sized region has seen fading of a number of intermediate spots. The other regions on the disc are comparatively small and simple.
A potentially large returning region has emerged on the southeastern limb. This is probably the return of notable region ex-AR3363, and corresponds to a strong signal in far-side products. However, there is low confidence for how much activity this region retains from its far-side transit.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	60	70	70
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: GOES16 X-Ray flux



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Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux is now back to background levels. No significant enhancement to flux levels was observed following the CME arrival on 01 Aug. The main risk of further proton storms through the period is from the complex region AR3380 in the southwest disc. Any significant flares from this region will bring a chance of further increases in proton flux, with a slight chance of exceeding S1/Minor Storm threshold.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 10 MeV) may have diurnal peaks at High (1000+ pfu) levels on Day 1 (3rd Aug), but is likely to drop out due to HSS or CME influence Days 2-4.

The associated 24 hour fluence is forecast to remain below Active (1e8 total pfu) but with a slight chance of rising above, mainly on Day 2 (4th Aug) before coronal hole and potential further CME influence. The Met Office REFM output is currently giving a reasonable steer for initial conditions, but confidence in the model falls low as the period advances.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	20	10	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REF Model

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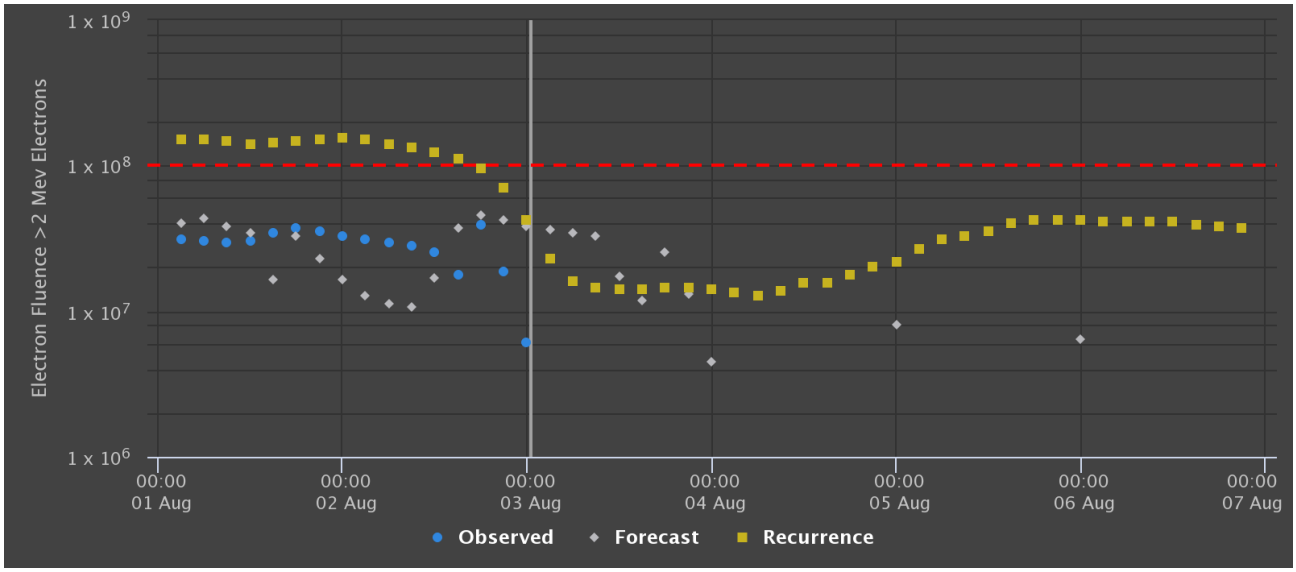

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